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(54) **DATA PROCESSING SYSTEM AND METHOD FOR PERMITTING A COMPUTER TO AUTOMATICALLY DETECT A PRESENCE OF AND ESTABLISH A COMMUNICATIONS LINK WITH A PRINTER**

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(52) **U.S. Cl.** **358/1.15**; 710/8; 710/62; 455/507; 455/517

(58) **Field of Search** 358/1.15; 710/8, 710/9, 52–62; 455/507, 517

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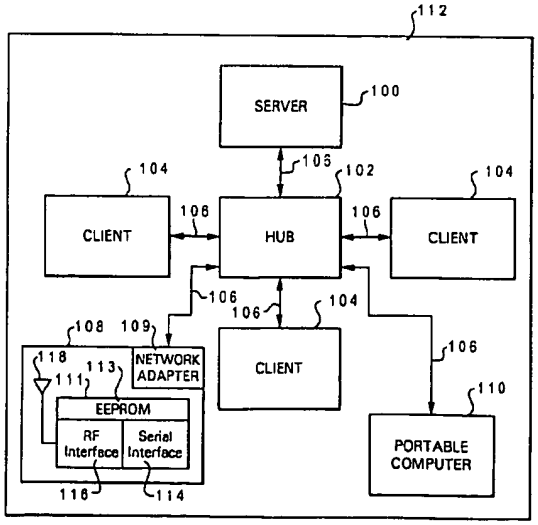
(57) **ABSTRACT**

A data processing system and method are described for permitting a portable computer to automatically detect the presence of a printer within a remote area, and responsive to the detection, automatically establishing a communications link with the printer. The portable computer is physically disconnected from the printer. The portable computer transmits a wireless query signal to the remote area. In response to a printer physically located within the remote area receiving the wireless query signal, the printer transmits a wireless reply signal to the remote area. In response to the portable computer receiving the wireless reply signal, the computer automatically establishes a communications link with the printer so that the computer may utilize the printer to print information. The communications link may be established with a printer for which the computer does not include a printer driver necessary for communicating with the printer.

15 Claims, 4 Drawing Sheets



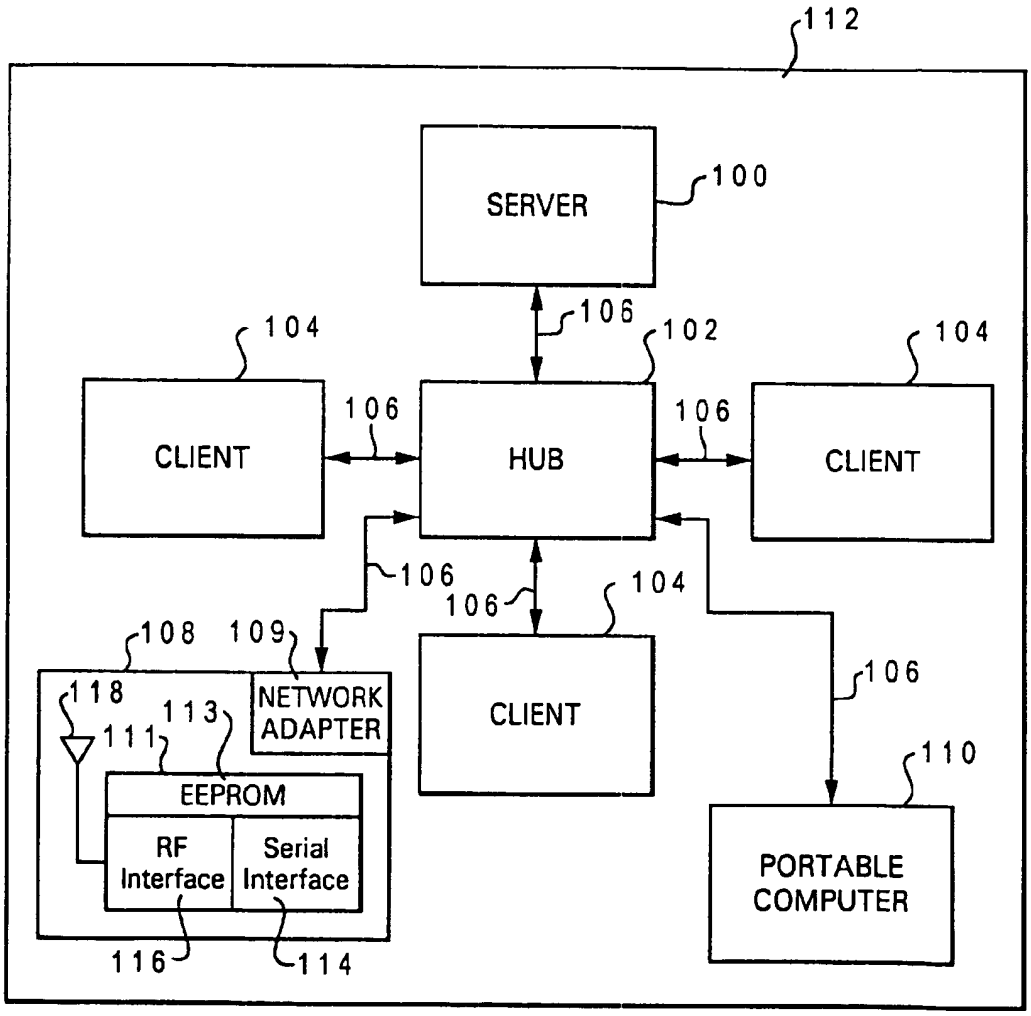

112
SERVER
100
106
102
104
CLIENT
106
HUB
106
CLIENT
104
106
106
104
108
109
118
113
111
NETWORK ADAPTER
CLIENT
106
110
EEPROM
RF Interface
Serial Interface
PORTABLE COMPUTER
116
114

Fig. 1

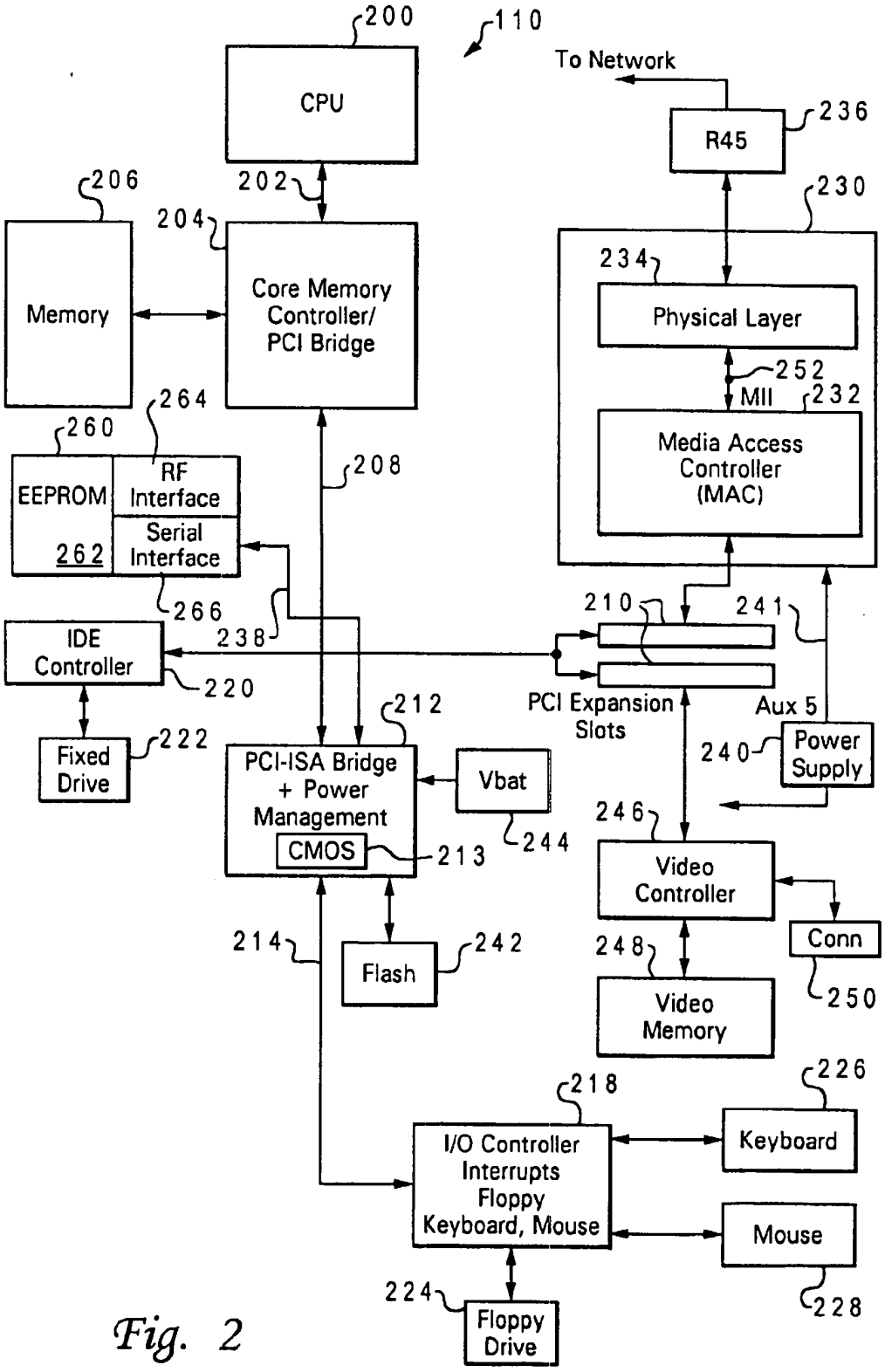

200
110
CPU
To Network
R45
236
206
202
204
230
Memory
Core Memory Controller/ PCI Bridge
234
Physical Layer
252
MII
232
Media Access Controller (MAC)
264
260
208
EEPROM
262
RF Interface
Serial Interface
266
210
241
238
IDE Controller
220
PCI Expansion Slots
Aux 5
212
240
Power Supply
222
Fixed Drive
PCI-ISA Bridge + Power Management
CMOS
213
Vbat
244
246
Video Controller
214
Flash
242
248
Conn
250
Video Memory
218
226
I/O Controller Interrupts Floppy Keyboard, Mouse
Keyboard
Mouse
228
224
Floppy Drive

Fig. 2

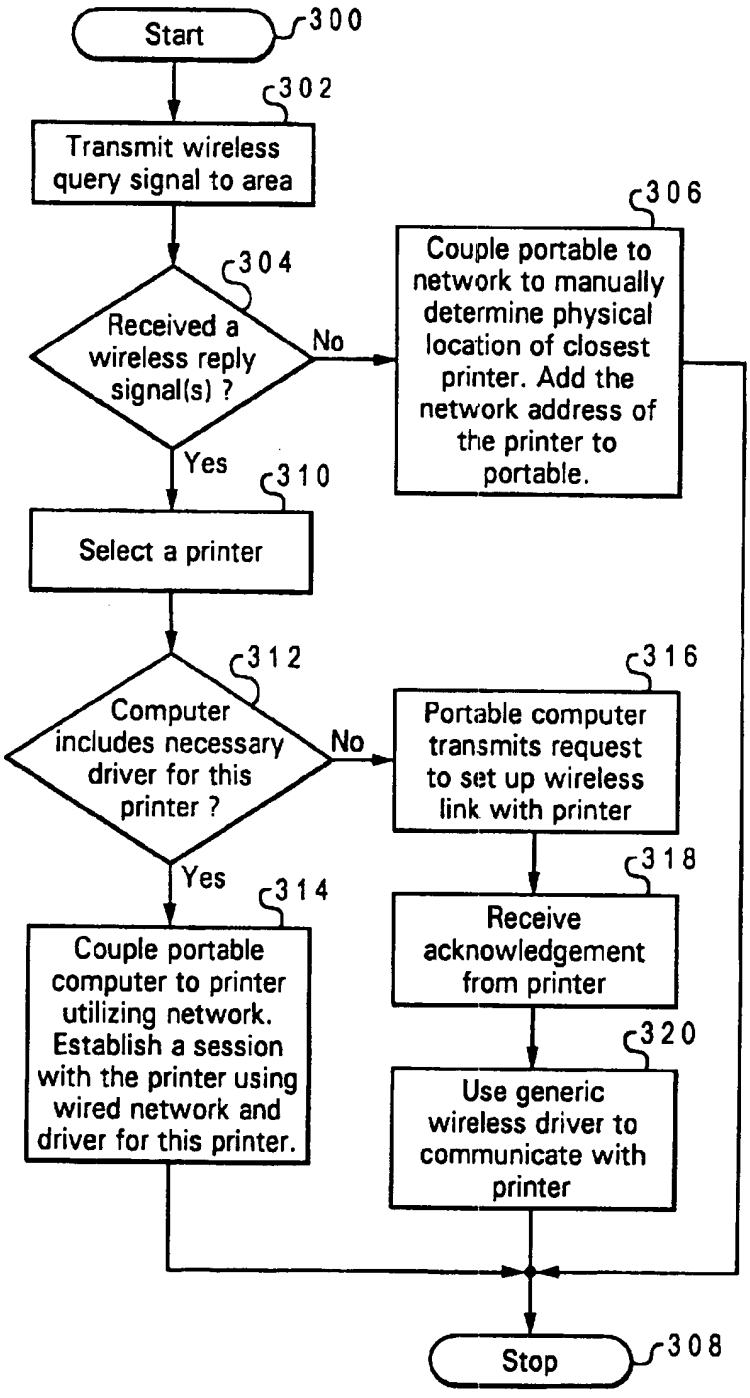

Start
300
302
Transmit wireless query signal to area
304
Received a wireless reply signal(s) ?
No
306
Couple portable to network to manually determine physical location of closest printer. Add the network address of the printer to portable.
Yes
310
Select a printer
312
Computer includes necessary driver for this printer ?
No
316
Portable computer transmits request to set up wireless link with printer
Yes
314
Couple portable computer to printer utilizing network. Establish a session with the printer using wired network and driver for this printer.
318
Receive acknowledgement from printer
320
Use generic wireless driver to communicate with printer
Stop
308

Fig. 3

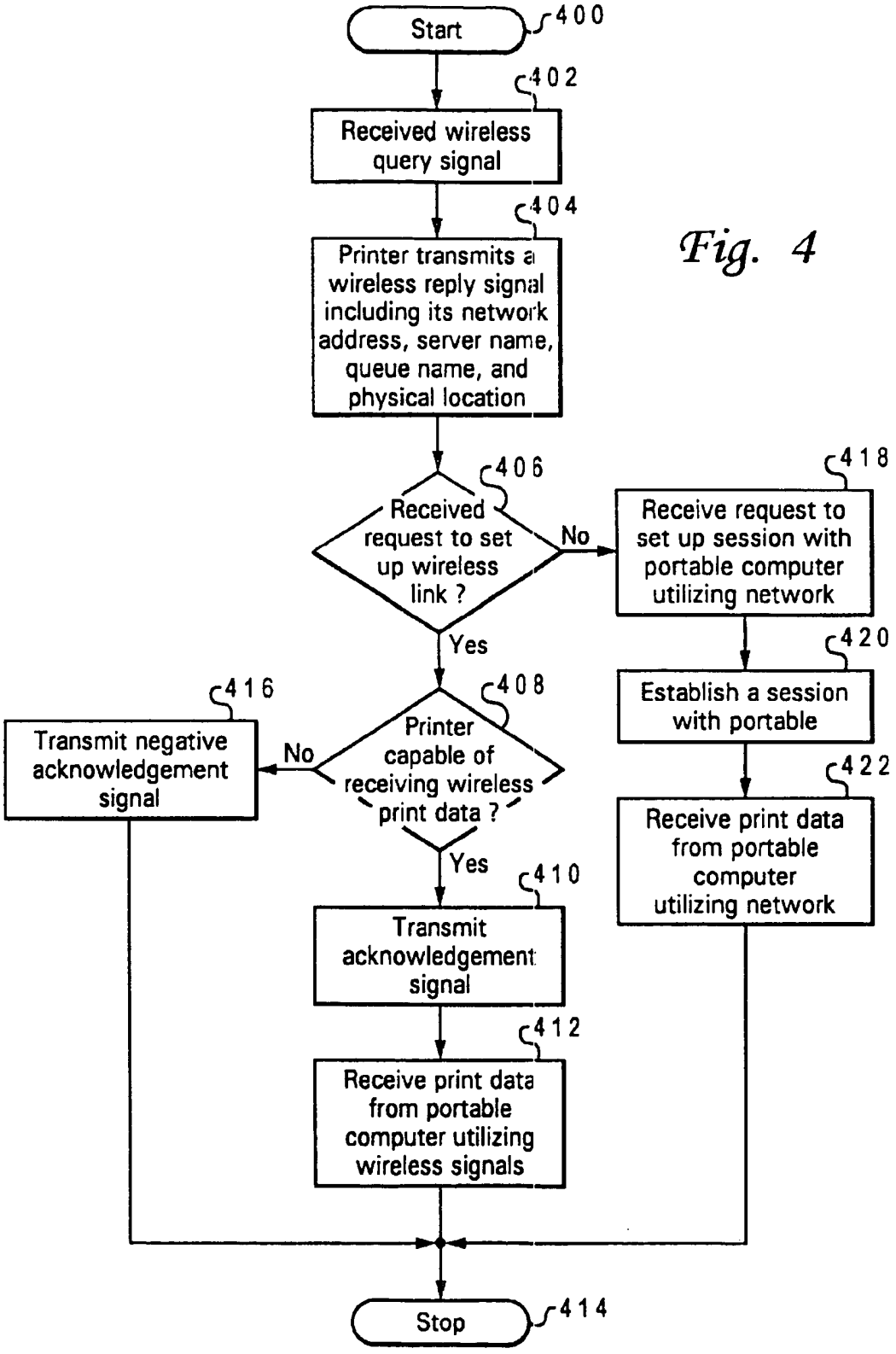

Start
400
402
Received wireless query signal
404
Printer transmits a wireless reply signal including its network address, server name, queue name, and physical location
406
Received request to set up wireless link ?
No
418
Receive request to set up session with portable computer utilizing network
420
Establish a session with portable
422
Receive print data from portable computer utilizing network
Yes
408
Printer capable of receiving wireless print data ?
No
416
Transmit negative acknowledgement signal
Yes
410
Transmit acknowledgement signal
412
Receive print data from portable computer utilizing wireless signals
Stop
414

Fig. 4

DATA PROCESSING SYSTEM AND METHOD FOR PERMITTING A COMPUTER TO AUTOMATICALLY DETECT A PRESENCE OF AND ESTABLISH A COMMUNICATIONS LINK WITH A PRINTER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates in general to data processing systems and, in particular, to a data processing system and method for permitting a computer to automatically detect and establish a communications link with a printer. Still more particularly, the present invention relates to a data processing system and method for permitting a computer to automatically detect and establish a communications link with a printer utilizing wireless signals.

2. Description of the Related Art

Personal computer systems are well known in the art. They have attained widespread use for providing computer power to many segments of today's modern society. Personal computers (PCs) may be defined as a desktop, floor standing, or portable microcomputer that includes a system unit having a central processing unit (CPU) and associated volatile and non-volatile memory, including random access memory (RAM) and basic input/output system read only memory (BIOS ROM), a system monitor, a keyboard, one or more flexible diskette drives, a CD-ROM drive, a fixed disk storage drive (also known as a "hard drive"), a pointing device such as a mouse, and an optional network interface adapter. One of the distinguishing characteristics of these systems is the use of a motherboard or system planar to electrically connect these components together. Examples of such personal computer systems are IBM's PC 300 series, Aptiva series, and Intellistation series.

Currently, it is difficult for a mobile computer user to locate and utilize printers at a remote site. A mobile computer user will likely be unaware of the physical locations of printers at the remote site. The mobile user must first locate a printer. One method for locating a printer is to require the computer user to physically connect the computer to the network, and utilize a listing of network printers. The user must then determine a physical location of the printer. The network address of the printer must also be added to the computer.

The user must also determine whether the computer includes the driver necessary for communicating with the printer. If the computer does not include the necessary driver, the driver must be added to the computer, or a different printer must be located.

Therefore a need exists for a data processing system and method for permitting a computer to automatically detect the presence of printers within a remote area, and thereafter, automatically establish a communications link with one of the printers in order to utilize the printer to print information such that the communications link may be established with a printer for which the computer does not include the necessary driver.

SUMMARY OF THE INVENTION

A data processing system and method are disclosed for permitting a portable computer to automatically detect the presence of a printer within a remote area, and responsive to the detection, automatically establishing a communications link with the printer. The portable computer is physically disconnected from the printer. The portable computer transmits a wireless query signal to the remote area. In response to a printer physically located within the remote area receiving the wireless query signal, the printer transmits a wireless reply signal to the remote area. In response to the portable computer receiving the wireless reply signal from the printer, the computer automatically establishes a communications link with the printer so that the computer may utilize the printer to print information. The communications link may be established with a printer for which the computer does not include a printer driver necessary for communicating with the printer. Additionally, the printer provides locating information so that the user can find the printer.

The above as well as additional objectives, features, and advantages of the present invention will become apparent in the following detailed written description.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features are set forth in the appended claims. The present invention itself, however, as well as a preferred mode of use, further objectives, and advantages thereof, will best be understood by reference to the following detailed description of a preferred embodiment when read in conjunction with the accompanying drawings, wherein:

FIG. 1 illustrates a pictorial representation of a data processing system in accordance with the method and system of the present invention;

FIG. 2 depicts a more detailed pictorial representation of a portable computer included within the data processing system of FIG. 1 in accordance with the method and system of the present invention;

FIG. 3 illustrates a high level flow chart which depicts a computer transmitting a wireless query signal to automatically detect a presence of and establish a communications link with a printer located in a remote area in accordance with the method and system of the present invention; and

FIG. 4 depicts a high level flow chart which illustrates a printer receiving and responding to a wireless query signal from a computer in accordance with the method and system of the present invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

A preferred embodiment of the present invention and its advantages are better understood by referring to FIGS. 1–4 of the drawings, like numerals being used for like and corresponding parts of the accompanying drawings.

The present invention is a method and system for permitting a computer to automatically detect a presence of a printer within a remote area, and thereafter, automatically establish a communications link with the printer. The communications link may be established even though the computer does not include the printer driver necessary for communicating with the particular type of printer.

The computer transmits a wireless query signal to an area which is different from the area in which the computer is typically operated. All printers physically located within the area which include a wireless transmitter/receiver device will receive the wireless query signal. The printers which received the wireless query signal will then transmit a wireless reply signal to the area. The computer will then receive the wireless reply signals transmitted by the printers. These steps occur while the computer is not physically coupled to any of the printers.

The user of the computer may then select one of the responding printers with which to establish a communica-

tions link. A communications link may be established with any of the responding printers regardless of whether or not the computer includes the necessary printer driver for the selected printer. If the computer does include the necessary printer driver, the computer is physically coupled to the wired network to which the printer is coupled. If the computer does not include the necessary printer driver, a wireless communications link is established between the computer and the printer. A generic, wireless driver is then utilized to permit the computer to communicate with the printer.

The computer will typically be a portable computer. However, those skilled in the art will recognize that the computer may be any type of portable, desktop, or other type of computer.

FIG. 1 illustrates a pictorial representation of a data processing system including a plurality of client computer systems **104** coupled to a server computer system **100** utilizing a hub **102** in accordance with the method and system of the present invention. Server computer system **100** is connected to a hub **102** utilizing a local area network (LAN) connector bus **106**. Respective client systems **104** also connect to hub **102** through respective LAN busses **106**. The preferred form of the network conforms to the Ethernet specification and uses such hubs.

A "network" may include any type of data communications channel, such as an Ethernet network, token ring, X.10, or X.25. Those skilled in the art will recognize that the invention described herein may be implemented utilizing any type of data communications channel. However, the preferred embodiment is implemented utilizing an Ethernet network.

A portable computer **110** and printer **108** may also be coupled to hub **102**. Portable computer **110** is described in more detail in FIG. 2. Printer **108** includes a network adapter **109** to couple printer **108** to network bus **106**. Printer **108** also includes a wireless device **111** which includes a storage device, such as EEPROM **113**, a serial interface **114** for coupling device **111** to other components, not shown, within printer **108**, a wireless interface **116** for transmitting and receiving radio frequency (RF) wireless signals, and an antenna **118** coupled to wireless interface **116**.

The data processing system is located within an area **112**. Area **112** is determined by the strength of a wireless signal computer **110** is capable of transmitting. When computer **110** transmits a wireless signal, it is received by printer **108** and any other printer located within area **112** which includes a wireless device.

FIG. 2 illustrates a pictorial representation of a portable computer **110** included within the data processing system of FIG. 1 in accordance with the method and system of the present invention. Portable computer **110** includes a central processing unit (CPU) **200** connected by address, control, and data busses **202** to a memory controller and peripheral component interconnect (PCI) bus bridge **204** which is also coupled to system memory **206**.

An integrated drive electronics (IDE) device controller **220** and a PCI bus to Industry Standard Architecture (ISA) bridge **212** are connected to PCI bus bridge **204** utilizing PCI bus **208**. IDE controller **220** provides for the attachment of IDE compatible storage devices such as fixed disk drive **222**. PCI/ISA bridge **212** provides an interface between PCI bus **208** and an optional feature or expansion bus such as the ISA bus **214**. PCI/ISA bridge **212** includes power management logic. A PCI standard expansion bus with connector slots **210** is coupled to PCI bridge **204**. PCI connector slots **210** may receive PCI bus compatible peripheral cards. PCI-ISA bridge controller **212** includes an interface for a flash memory **242**, which includes microcode which computer **110** executes upon power-on. Flash memory **242** is an electrically erasable programmable read only memory (EEPROM) module and includes BIOS that is used to interface between the I/O devices and operating system. PCI-ISA bridge controller **212** also includes CMOS storage **213** that holds initialization settings which represent system configuration data. Storage **213** includes values which describe the present configuration of computer **110**. For example, storage **213** includes information describing the list of initial program load (IPL) devices set by a user and the sequence to be used for a particular power method, the type of display, the amount of memory, time date, etc. Furthermore, this data is stored in storage **213** whenever a special configuration program, such as configuration/setup is executed. PCI-ISA bridge controller **212** is supplied power from battery **244** to prevent loss of configuration data in storage **213**.

An I/O controller **218** is coupled to PCI-ISA bridge controller **212**. I/O controller **218** controls communication between PCI-ISA bridge controller **212** and devices and peripherals such as floppy drive **224**, keyboard **226**, and mouse **228** so that these devices may communicate with CPU **200**.

Portable computer **110** includes a video controller **246** which may, for example, be plugged into one of connector slots **210**. Video controller **246** is connected to video memory **248**. The image in video memory **248** is read by controller **246** and displayed on a monitor (not shown) which is connected to computer **110** through connector **250**. computer **110** also includes a network adapter **230** which may, for example, be plugged into one of the PCI connector slots **210** (as illustrated) in order to permit computer **110** to communicate with a LAN via connector **236** to hub **102**.

Portable computer **110** includes a special power supply **240** which supplies full normal system power (not depicted), and has an auxiliary power main AUX **5** **241** which supplies full time auxiliary power to the power management logic **212** and to network adapter **230**. In response to a receipt of the wakeup signal, normal system power from power supply **240** is turned on and then powers up computer **110**.

Network adapter **230** includes a physical layer **234** and a media access controller (MAC) **232** connected together utilizing a Media Independent Interface (MII) bus **252**. The MII bus **252** is a specification of signals and protocols which define the interfacing of a 10/100 Mbps Ethernet Media Access Controller (MAC) **232** to the underlying physical layer **234**.

MAC **232** processes digital network signals, and serves as an interface between a shared data path, i.e. the MII bus **252**, and the PCI bus **208**. MAC **232** performs a number of functions in the transmission and reception of data packets. For example, during the transmission of data, MAC **232** assembles the data to be transmitted into a packet with address and error detection fields. Conversely, during the reception of a packet, MAC **232** disassembles the packet and performs address checking and error detection. In addition, MAC **232** typically performs encoding/decoding of digital signals transmitted over the shared path and performs preamble generation/removal, as well as bit transmission/reception. In a preferred embodiment, MAC **232** is an Intel 82557 chip. However, those skilled in the art will recognize that the functional blocks depicted in network adapter **230** may be manufactured utilizing a single piece of silicon.

Physical layer **234** conditions analog signals to go out to the network via an R45 connector **236**. Physical layer **234** may be a fully integrated device supporting 10 and 100 Mb/s CSMA/CD Ethernet applications. Physical layer **234** receives parallel data from the MII local bus **252** and converts it to serial data for transmission through connector **236** and over the network. Physical layer **234** is also responsible for wave shaping and provides analog voltages to the network. In a preferred embodiment, physical layer **234** is implemented utilizing an Integrated Services chip ICS-1890.

Physical layer **234** includes auto-negotiation logic that serves three primary purposes. First, it determines the capabilities of computer **110**. Second, it advertises its own capabilities to server computer **100**. Third, it establishes a connection with server computer **100** using the highest performance connection technology.

Computer **110** includes a wireless device **260** which includes a storage device, such as EEPROM **262**, a serial interface **266** coupled to a system management bus **238** for permitting device **260** to communicate with other components of computer **110**, a wireless interface **264** for transmitting and receiving radio frequency (RF) wireless signals, and an antenna **120** coupled to wireless interface **264**.

System management (SM) bus **238** is a two-wire, low speed, serial bus used to interconnect management and monitoring devices. Those skilled in the art will recognize that another bus within the computer may be utilized to interconnect these devices.

FIG. **3** illustrates a high level flow chart which depicts a computer transmitting a wireless query signal to automatically detect a presence of and establish a communications link with a printer located in a remote area in accordance with the method and system of the present invention. The process starts as depicted at block **300** and thereafter passes to block **302** which illustrates the transmission of a wireless query signal. The wireless signal will be received within a reception area which is determined by the strength of the wireless signal. Next, block **304** depicts a determination of whether or not the portable computer received a wireless reply signal. If a determination is made that the portable computer has not received a wireless reply signal, the process passes to block **306** which illustrates requiring a user to couple the portable computer to the network to manually determine the physical location of the closest printer. Once the user has determined the closest printer, the user must add the network address of this printer to the portable. The process then terminates as illustrated at block **308**.

Referring again to block **304**, if a determination is made that the portable computer has received a wireless reply signal, the process passes to block **310**. The portable computer may receive a wireless reply signal from several printers. Block **310** depicts a selection of one of the printers which transmitted a wireless reply signal. Next, block **312** illustrates a determination of whether or not the portable computer includes the necessary driver for communicating with the selected printer. If a determination is made that the portable computer does include the necessary driver for the selected printer, the process passes to block **314** which depicts the portable computer being coupled to the network, and then establishing a session with the printer using the network and the necessary driver. Thereafter, the process terminates as illustrated at block **308**.

Referring again to block **312**, if a determination is made that the portable computer does not include the necessary driver to communicate with the selected printer, the process passes to block **316** which illustrates the portable computer transmitting a request to the printer to set up a wireless link with the printer. Next, block **318** depicts the portable computer receiving an acknowledgement from the printer that the printer is capable of communicating with the portable computer via a wireless link. The process then passes to block **320** which illustrates the portable computer utilizing a generic wireless driver to communicate with the printer. The process then terminates as depicted at block **308**.

FIG. **4** depicts a high level flow chart which illustrates a printer receiving and responding to a wireless query signal from a computer in accordance with the method and system of the present invention. The process starts as depicted at block **400** and thereafter passes to block **402** which illustrates the printer receiving a wireless query signal. The process then passes to block **404** which depicts the printer transmitting a wireless reply signal. The wireless reply signal includes the network address, server name, queue name, and physical location associated with this printer. Next, block **406** illustrates a determination of whether or not the printer received a request from the computer to set up a wireless link. If a determination is made that the printer has received a request from a computer to set up a wireless link, the process passes to block **408** which illustrates a determination of whether or not the printer is capable of receiving print data utilizing a wireless link. If a determination is made that the printer is capable of receiving print data, the process passes to block **410** which depicts the printer transmitting an acknowledgement signal to the computer. Next, block **412** illustrates the receipt of print data by the printer from the computer utilizing a wireless communication link. The process then terminates as depicted at block **414**.

Referring again to block **408**, if a determination is made that the printer is not capable of receiving print data, the process passes to block **416** which illustrates the printer transmitting a negative acknowledgement to the portable computer. The process then terminates as depicted at block **414**.

Referring again to block **406**, if a determination is made that the printer has not received a request to set up a wireless link with a portable computer, the process passes to block **418** which depicts the printer receiving a request to set up a session with the portable computer utilizing the network. Next, block **420** illustrates the printer and portable computer establishing a session. Thereafter, block **422** depicts the printer receiving print data from the portable computer utilizing the network. The process then terminates as illustrated at block **414**.

While a preferred embodiment has been particularly shown and described, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the present invention.

What is claimed is:

1. A method in a data processing system for automatically detecting a presence of a printer within a remote area, and responsive to said detection, automatically establishing a communications link with said printer, said method comprising the steps of:

a computer included within said system transmitting a wireless query signal to said remote area;

in response to a printer physically located within said remote area receiving said wireless query signal, said printer transmitting a wireless reply signal to said remote area;

in response to said computer receiving said wireless reply signal, said computer automatically establishing a com-

munications link with said printer, wherein said computer utilizes said printer to print information;

establishing a wireless interface within said printer for transmitting and receiving wireless signals;

establishing a wireless interface within said computer for transmitting and receiving wireless signals;

in response to said computer receiving said wireless reply signal, said computer determining whether said computer is capable of communication with said printer utilizing a wired network;

in response to a determination that a computer is capable of communication with said printer utilizing said wired network, coupling said computer to said printer utilizing said wired network; and

said computer automatically configuring itselfto communicate with said printer utilizing said wired network.

2. The method according to claim **1**, further comprising the steps of:

in response to a determination that computer is not capable of communicating with said printer utilizing said wired network, said computer remaining disconnected from said printer; and

said computer automatically configuring itself to communicate with said printer utilizing a wireless communications link.

3. The method according to claim **2**, further comprising the step of said computer automatically configuring itself to communicate with said printer without a user of said computer being aware of a network address of said printer.

4. The method according to claim **3**, further comprising the step of said printer transmitting said reply signal including an identification of a printer type of said printer.

5. The method according to claim **4**, further comprising the step of said printer transmitting said reply signal including an identification of a physical location and said network address of said printer.

6. The method according to claim **5**, further comprising the steps of:

said computer determining whether said computer includes a software driver for communicating with said printer type;

in response to a determination that said computer does include said driver, coupling said computer to said printer utilizing said wired network; and

said computer utilizing said driver to communicate with said printer utilizing said wired network.

7. The method according to claim **6**, further comprising the steps of:

in response to a determination that said computer does not include said driver, said computer remaining disconnected from said printer; and

said computer utilizing a generic, wireless driver to communicate with said printer utilizing wireless signals.

8. A data processing system for automatically detecting a presence of a printer within a remote area, and responsive to said detection, automatically establishing a communications link with said printer, said computer being physically disconnected from said printer, comprising:

a computer included within said system capable of transmitting a wireless query signal to said remote area;

in response to a printer physically located within said remote area receiving said wireless query signal, said printer capable of transmitting a wireless reply signal to said remote area;

in response to said computer receiving said wireless reply signal, said computer capable of automatically establishing a communications link with said printer, wherein said computer utilizes said printer to print information;

a wireless interface included within said printer for transmitting and receiving wireless signals;

a wireless interface included within said computer for transmitting and receiving wireless signals;

in response to said computer receiving said wireless reply signal, said computer executing code for determining whether said computer is capable of communicating with said printer utilizing a wired network;

in response to a determination that computer is capable of communicating with said printer utilizing said wired network, said computer capable of being coupled to said printer utilizing said wired network; and

said computer executing code for automatically configuring itself to communicate with said printer utilizing said wired network.

9. The system according to claim **8**, further comprising:

in response to a determination that computer is not capable of communicating with said printer utilizing said wired network, said computer capable of remaining disconnected from said printer; and

said computer executing code for automatically configuring itself to communicate with said printer utilizing a wireless communications link.

10. The system according to claim **9**, further comprising said computer executing code for automatically configuring itself to communicate with said printer without a user of said computer being aware of a network address of said printer.

11. The system according to claim **10**, further comprising said printer capable of transmitting said reply signal including an identification of a printer type of said printer.

12. The system according to claim **11**, further comprising said printer capable of transmitting said reply signal including an identification of a physical location and said network address of said printer.

13. The system according to claim **12**, further comprising:

said computer executing code for determining whether said computer includes a software driver for communicating with said printer type;

in response to a determination that said computer does include said driver, said computer capable of being coupled to said printer utilizing a wired network; and

said computer executing code for utilizing said driver to communicate with said printer utilizing said wired network.

14. The system according to claim **13**, further comprising:

in response to a determination that said computer does not include said driver, said computer capable of remaining disconnected from said printer; and

said computer executing code for utilizing a generic, wireless driver to communicate with said printer utilizing wireless signals.

15. A data processing system for automatically detecting a presence of a printer within a remote area, and responsive to said detection, automatically establishing a communications link with said printer, said computer being physically disconnected from said printer, comprising:

said computer including a wireless interface for transmitting and receiving wireless signals;

said printer including a wireless interface for transmitting and receiving wireless signals;

a computer included within said system capable of transmitting a wireless query signal to said remote area;

in response to a printer physically located within said remote area receiving said wireless query signal, said printer capable of transmitting a wireless reply signal to said remote area, said reply signal including an identification of a printer type of said printer, an identification of a physical location, and a network address of said printer;

in response to said computer receiving said wireless reply signal, said computer executing code for determining whether said computer is capable of communicating with said printer utilizing a wired network by determining whether said computer includes a software driver for communicating with a type of printer including said printer;

in response to a determination that said computer does include said driver, said computer capable of being coupled to said printer utilizing a wired network and said computer executing code for utilizing said driver to communicate with said printer utilizing said wired network, said computer executing code for automatically configuring itself to communicate with said printer without a user of said computer being aware of said network address of said printer; and

in response to a determination that said computer does not include said driver, said computer capable of remaining disconnected from said printer and said computer executing code for utilizing a generic, wireless driver to communicate with said printer utilizing wireless signals.

* * * * *